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Stab Wounds of the Brain

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Unlike the penetrating injuries to the brain caused by missiles, injuries by stabbing are largely restricted to the wound tract. Early recognition, debridement and judicious antibiotic therapy can limit or prevent complications in the management of stab wounds. Among the common sequelae of stab wounds of the brain are pneumocephalus, meningitis, intracerebral hemorrhage and direct blood vessel or nerve injury.

LOW-VELOCITY PENETRATING WOUNDS of the brain are uncommon because the skull usually provides an effective protective barrier. The skull can be penetrated easily, however, through its foramina and in areas of thin bone. Dujovny recently emphasized the vulnerability of the brain to penetrating wounds of the orbit and the thin calvarium of children[1] and Dolling and coworkers pointed out the relative ease with which the squamous portion of the temporal bone can be perforated in a child.[2] The adult calvarium is less easily traversed, yet stab wounds and their complications continue to be clinical problems. The case reports to follow exemplify not only the penetrability of the adult calvarium, but also early and delayed sequelae resulting from stab wounds of the brain.

Reports of Cases

CASE 1. A 43-year-old man lost consciousness minutes after having been stabbed with a screwdriver in the right temporal area. The 7 mm puncture wound extruded hematoma but not cerebral tissue. On neurological examination the patient was comatose and responded to pain with decerebrate posturing. Conjugate deviation of gaze to the left could not be overcome with the doll's eye maneuver. There were bilateral iridectomy residua, intact corneal reflexes, absent gag reflex and a flaccid left hemiplegia. An arteriogram showed right temporal lobe swelling but no abnormalities in the posterior fossa. Debridement by temporal craniectomy showed a narrow hemorrhagic tract with a few superficial bone fragments. Postoperatively the complete right gaze palsy resolved to a "one and a half" syndrome.[3] On an arteriogram done 16 days after injury a traumatic aneurysm was noted which had developed from the right superior cerebellar artery (Figure 1). The patient regained full alertness and comprehension over two weeks but had residual right pontine deficits including: left hemiplegia, right trochlear palsy, right internuclear ophthalmoplegia, ocular bobbing, palatal and pharyngeal myoclonus, and aphonia.

CASE 2. A 22-year-old man was admitted to hospital in an obtunded state after having been found in his bed in vomitus. Body temperature was 103.2°F (39.6°C), blood pressure was 150/90 mm of mercury and his neck was rigid; he responded to pain with nonpurposeful thrashing movements. Respirations were Cheyne-Stokes type. Fundi were normal, pupils were 4 mm in diameter and briskly reactive to light. Conjugate

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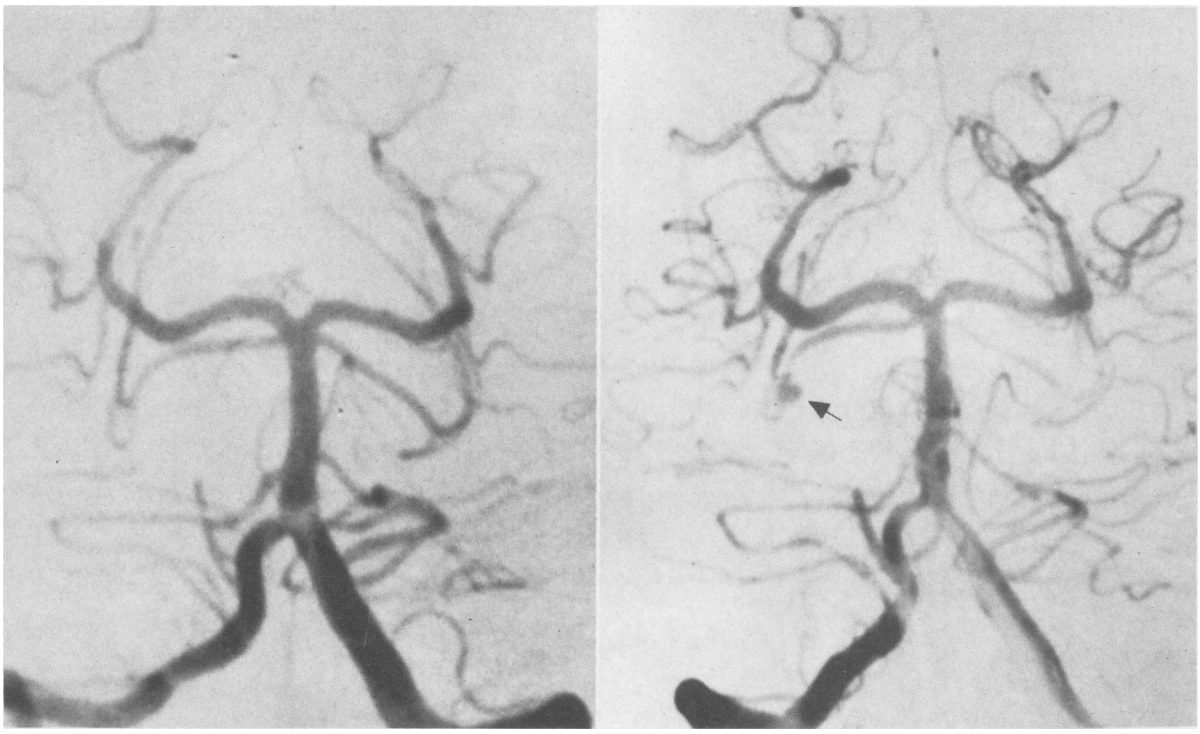

Figure 1.—Left, right vertebral angiogram on the day of injury. No abnormality is identified. **Right,** right vertebral angiogram 16 days after injury. An aneurysm of the right superior cerebellar artery is present **(arrow).**

deviation of gaze to the right was present, but could be overcome by doll's eye maneuver. Reflexes were 4+ throughout with bilateral Babinski signs. A lumbar puncture yielded bloody fluid with an opening pressure of 500 mm of water.

The patient became apneic during an arteriogram. The angiographs disclosed a very large posterior temporal mass (Figure 2). Angiographic signs of ventricular enlargement were present. A previously unrecognized 5 mm puncture wound was discovered 5 cm above and behind the meatus during head preparation for craniotomy. The large hematoma was evacuated. Tiny fragments of bone and hair were removed from the lacerated cortex and white matter. Postoperatively Cheyne-Stokes respirations returned, but the patient became apneic and died 24 hours later.

On autopsy an intraventricular clot and extensive hemorrhagic laceration of brain were noted.

CASE 3. A 27-year-old schizophrenic man entered the hospital after stabbing a paring knife with a 4-inch blade into his forehead. Findings on examination were normal except for delusional ideation, and a 3 cm by 2 mm horizontal gash in the midline just above the nasion. Body temperature was normal. X-ray films of the skull showed a fracture through the right frontal sinus and pneumocephalus (Figure 3). Antibiotic therapy was begun. The wound was debrided and the dura closed. The patient remained afebrile until the sixth postoperative day when his temperature rose to 101.8°F (38.8°C) and he became incoherent. Findings on lumbar puncture showed Enterobacter meningitis which was eliminated by adding chloramphenicol to the antibiotic regimen. The patient recovered completely.

CASE 4. A 22-year-old man was admitted to San Francisco General Hospital after having been assaulted. On physical examination an irregular 3 cm laceration in the superior posterior frontal area was found. Results of neurological examination were normal except for obtundation with preserved purposeful movements and a mild right hemiparesis. On radiographs of the skull a 3 cm linear skull fracture beneath the laceration was seen. Within 30 minutes of admission the patient's left pupil dilated and reacted poorly to light. Burr holes showed there to be intracranial hypertension without an extracerebral hematoma. An arteriogram done immediately after trephination confirmed temporoparietal swelling without a localized parenchymal hematoma. Intracranial pressure was monitored after operation by a sub-

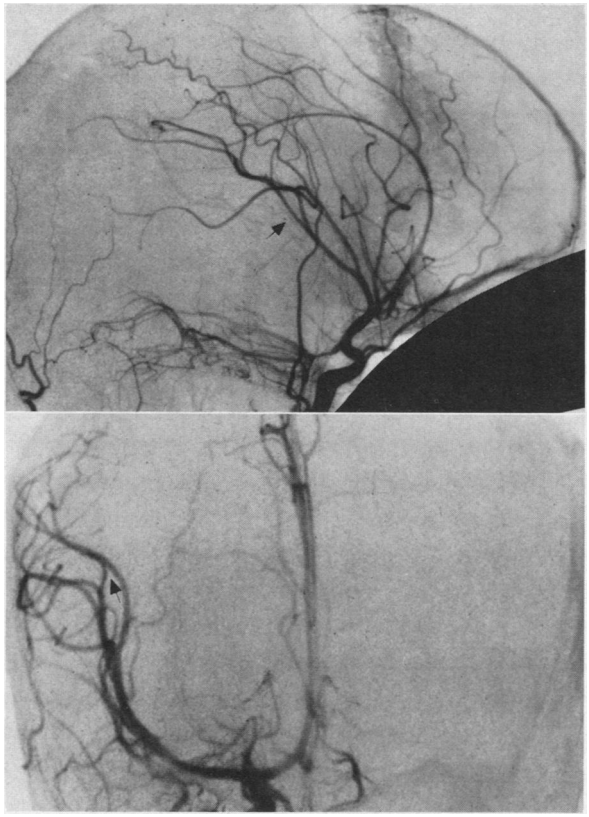

Figure 2.—Upper, right common carotid angiogram. Lateral projection. The posterior branches of the right middle cerebral artery are displaced anterosuperiorly **(arrow)** leaving a hypovascular area in the posterior temporal lobe. The anterior cerebral artery is straightened and elevated as a result of ventricular enlargement. **Lower,** right common carotid angiogram. Frontal projection. The sylvian point **(arrow)** is elevated. Ventriculomegaly is suggested by the increased distance between the anterior and middle cerebral arteries and the straightening of the anterior cerebral artery.

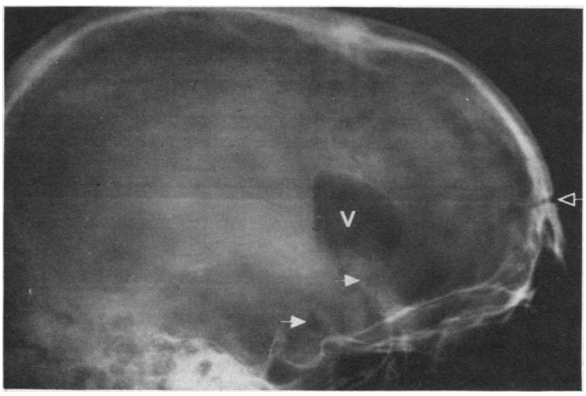

Figure 3.—Skull, lateral projection, brow up. There is a fracture through the frontal bone **(open arrow)** which involved the right frontal sinus. Air is present within the subarachnoid space **(closed arrows)** and the right ventricle **(V).**

dural catheter and managed with administration of mannitol and glycerol, and with controlled hyperventilation. A week later intracranial pressure rose to 50 mm of mercury, and both pupils became dilated and fixed. Increased serum osmolality prevented further therapy with osmotic agents. The patient became bradycardic and arrested while being ventilated.

On autopsy no infection was found but there was massive cerebral edema surrounding a deep laceration beneath the frontal fracture. Small bone fragments within brain tissue confirmed the penetrating nature of the injury.

Discussion

Medical reports of stab wounds of the brain date from as early as 1806.[4] Penfield[5] described the pathological features of experimental stab wounds with cannulas. Pilcher[6] compiled a lengthy list of objects known to have penetrated the brain that included knives, pitchforks, crochet hooks, knitting needles, breech pins, umbrella bibs, crowbars and iron rods. More recently, Markham[7] added car antennas to the list and Dolling added pairs of scissors.[2]

Nonmissile penetrating craniocerebral injuries are more amenable to treatment than are missile injuries. A stab wound creates a narrow hemorrhagic infarction which is largely restricted to the wound tract.[8] Concentric zones of coagulative necrosis do not result from stab wounds as they do from explosives and the cavitating forces of missiles.[8,9] Similarly contre coup injuries rarely occur, if at all, from stab wounds.[8] Unless the stabbing instrument is swept across the brain before withdrawal (as in case 4), the resultant lesion is focal. Therefore, in the absence of a direct injury to the brain stem or direct laceration of a major vessel, the prognosis for recovery may be good.

The reported stab wounds have usually penetrated the skull either in the vicinity of the orbits or in the temporal areas where the vault is thin.[2] Even full-thickness skull, however, will not stop a forcefully thrust sharp object. Although radiating fractures from the entry wound are common, the skull fracture often corresponds to the dimensions of the penetrating object.[8]

Early recognition of stab wounds of the brain is essential to ensure early treatment and a good outcome. Nonetheless, recognition remains difficult; neither the usual sites nor the appearances of entry wounds are characteristic of stab wounds

alone. Puncture wounds from screwdrivers and icepicks inside the hairline are especially easy to miss (case 2 provides an example). Congruent scalp lacerations and underlying fractures should always arouse suspicion.

Once recognized, treatment is straightforward, consisting of hemostasis, debridement and dural closure. The surgical approach is essentially that used for missiles[10]—debridement and dural repair.

REFERENCES

1. Dujovny M, Osgood CP, Maroon JC, et al: Penetrating intracranial foreign bodies in children. J Trauma 15:981-986, 1975

2. Dooling JA, Bell WE, Whitehurst WR: Penetrating skull wound with a pair of scissors: Case report. J Neurosurg 26:636-638, 1967

3. Fischer CM: Some neuro-ophthalmological observations. J Neurol Neurosurg Psychiat 30:382-392, 1967

4. Mason F: Case of a young man who had a pitchfork driven into his head four inches who speedily got well. Mar 10, 1806. Lancet 1:700-701, 1870

5. Penfield W, Buckley R: Punctures of the brain. Arch Neurol Psychiat 20:1-13, 1928

6. Pilcher C: Penetrating wounds of the brain. Ann Surg 103: 173-198, 1936

7. Markham JW, Mccleve PE, Lynge HN: Penetrating craniocerebral injuries. J Neurosurg 21:1095-1097, 1964

8. Lindenberg R: Trauma of meninges and brain, *In* Minckler J: Pathology of the Nervous System, Vol 2. New York, McGraw-Hill, 1971, p 1721

9. Campbell E, Kuhlenbeck H: Mortal brain wounds: A pathologic study. J Neuropath Exp Neurol 9:139-149, 1950

10. Merirowsky AM: Penetrating craniocerebral trauma. Clin Neurosurg 12:254-265, 1965

Diagnosing Acute Intussusception

The diagnosis of acute intussusception is suspected on the basis of age (80 percent of cases are in the first two years of life); sex (three boys to one girl); symptoms of intermittent colicky, severe, "labor" pains—even going into the knee-chest position; and appropriate signs of a palpable, sausage-shaped mass, frequently in the right upper quadrant under the liver where it is most difficult to feel. With family doctors taking particular note when a mother says something like "My child is having labor pains," we are picking up the diagnosis earlier. And, in 70 percent of these cases, a barium enema is effective and surgical operation is not required.

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